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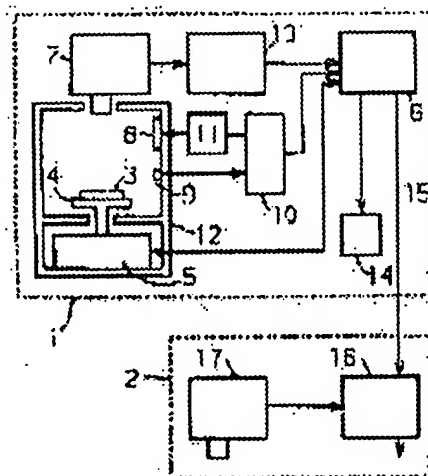
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(54) APPARATUS FOR PREPARING CALIBRATION CURVE OF MOISTURE METER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an apparatus capable of preparing a highly accurate calibration curve even when the material of an object to be measured is changed or a moisture meter has any instrumental error.

SOLUTION: The title apparatus is provided with a drying means 8 for drying an object 3 to be measured, a weighing means 5 for measuring the weight of the object 3, a first moisture meter 7 for measuring the infrared absorptance by using a moisture content including in the object 3, and a processing means 6 which computes a calibration curve according to the weight signal measured by the means 5 and the measuring signal measured by the meter 7, as well as a correction value so that the measuring signal measured by a second moisture meter 17 may correspond to the measuring signal measured by the first moisture meter 7 according to every measuring signal at the time when a reference body is measured by the meters 7 and 17 respectively.



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CLAIMS

[Claim(s)]

[Claim 1] A desiccation means to dry a device under test, and a gravimetry means to measure the weight of a device under test, While calculating a calibration curve based on the measurement signal measured with the 1st moisture meter for measuring the rate of infrared absorption by the moisture contained in a device under test, and the weight signal and the 1st moisture meter which were measured with these gravimetries means The calibration-curve listing device of the moisture meter characterized by having a processing means to calculate correction value so that the measurement signal of the 2nd moisture meter may correspond to the measurement signal of the 1st moisture meter based on each measurement signal when measuring a criteria object with the 1st moisture meter and 2nd moisture meter.

[Claim 2] The 2nd moisture meter which can measure moisture regain based on the above-mentioned calibration-curve data or correction value data for which it asked by the calibration-curve listing device of claim 1.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the calibration-curve listing device of the moisture meter which measures the moisture regain of the measuring object-ed using infrared radiation.

[0002]

[Description of the Prior Art] Conventionally, two colors or 3 color infrared moisture meter which asks for the moisture regain of the measuring object-ed from the rate of infrared absorption which is the ratio signal of the measurement signal of the reflected light from the measuring object-ed in the absorption wavelength range of moisture thru/or the transmitted light and the comparison signal of 1 or 2 of the reflected light in the non-absorption band of moisture thru/or the transmitted light as a moisture meter which measures moisture regain using infrared radiation is known.

[0003]

[Problem(s) to be Solved by the Invention] However, since the relation of the absorption coefficient and moisture regain by the moisture of the infrared radiation which is the output of a moisture meter changes greatly with the class of device under test, the quality of the material, presentations, etc., it needs to create a calibration curve for every measuring object. Moreover, when moisture meters differed, there was a possibility that an error might arise by the ****.

[0004] Even if the purpose of this invention has **** in change of the quality of the material of a device under test etc., and a moisture meter in view of the above point, it is offering the equipment in which highly precise calibration-curve creation is possible.

[0005]

[Means for Solving the Problem] A desiccation means by which this invention dries a device under test, and a gravimetry means to measure the weight of a device under test, While calculating a calibration curve based on the measurement signal measured with the 1st moisture meter for measuring the rate of infrared absorption by the moisture contained in a device under test, and the weight signal and the 1st moisture meter which were measured with these gravimetries means It is the calibration-curve listing device of the moisture meter equipped with a processing means to calculate correction value so that the measurement signal of the 2nd moisture meter may correspond to the measurement signal of the 1st moisture meter based on each measurement signal when measuring a criteria object with the 1st moisture meter and 2nd moisture meter.

[0006]

[Example] Drawing 1 is the configuration explanatory view showing one example of the calibration-curve listing device of the moisture meter of this invention. The calibration-curve listing device 1 of this moisture meter carries out automatic creation of the calibration curve of a device under test based on the infrared absorption data based on the moisture contained in the device under test measured by the gravimetry means, and seems to measure moisture in the moisture meter of water measurement equipment 2 based on the data of this created calibration curve.

[0007] In drawing, a device under test like the paper in which 3 tends to create a calibration curve, the

installation base on which 4 puts a device under test 3, and 5 are gravimetry means like an electronic balance, measure the weight of the device under test 3 on the installation base 4, and output weight signal data to a processing means 6 like a personal computer. Moreover, 7 is a moisture meter for measuring the rate of infrared absorption by the moisture contained in a device under test 3. 8 is desiccation means, such as a heater, an infrared-heating lamp, and microwave, high-frequency-heating equipment; and dries a device under test 3. A thermometer 9 detects this heating temperature, the actuation means 11, such as a thyristor, are driven by the control means 10, and it controls to predetermined temperature. Moreover, the whole is used as a heat insulation container 12 like a thermostat.

[0008] 13 is an operation means to amplify the output of a moisture meter 7 with an amplifier, and to output to a processing means 6 like a personal computer as a digital signal with an A/D converter, and if a measurement signal can be directly outputted to the processing means 6 from a moisture meter 7, it is omissible.

[0009] 2 is water measurement equipment, for example, the measurement signal of the moisture meter 17 on online is outputted to the operation means 16, using the calibration-curve data which were obtained by the calibration-curve listing device 1, and were inputted directly or indirectly, this operation means 16 measures moisture regain, and it can display in digital one or it can output it outside.

[0010] Calibration-curve creation is performed by [as being the following]. The gravimetry means 5 is reset by the signal from the processing means 6, a device under test 3 is put on the installation base 4, and the measurement signal of a moisture meter 7 and the weight signal of the gravimetry means 5 are incorporated with the processing means 6. Next, the desiccation means 8 is set to ON and it considers as predetermined temperature by the control means 10. If measurement is started, the processing means 6 will repeat and acquire the weight signal of the gravimetry means 5, and the measurement signal of a moisture meter 7 for example, at intervals of predetermined time. And if predetermined time progress is carried out, or the rate of change of a weight signal becomes sufficiently small and it is judged as an absolute dry condition, the processing means 6 will make the desiccation means 8 off, will incorporate the weight signal data at the time of a bone dry, and the measurement-signal data of a moisture meter, and will end measurement.

[0011] And in weight signal data, the moisture regain z_i of y_i , then each right criteria in a time is obtained by y_0 in the time of a bone dry, and is obtained by the degree type with the processing means 6 at each time ($i=0, 1$ and $2, \dots$).

[0012]

$$z_i = [(y_i - y_0) / y_i] \times 100 [\%] \quad (1)$$

Moreover, the measurement signal S of the reflected light from the device under test 3 in the absorption wavelength range of moisture obtained as a measurement signal of a moisture meter 7 and the comparison signals S_1 and S_2 of 1 or 2 of the reflected light in the non-absorption band of moisture are made to input into the processing means 6, and the ratio signal x_i which is a rate of infrared absorption sets the time of a bone dry to x_0 , and can be found in a degree type ($i=0, 1$ and $2, \dots$).

[0013]

$$x_i = 2S / (R_1 + R_2) \quad (2)$$

And if the ratio signal x_i of the (2)-type moisture meter 7 obtained in this way and the moisture regain z_i of (1) type can express with a linear expression, a calibration curve like a degree type can be found with a least square method etc. from the data of Above z_i and x_i .

[0014]

$$z = px + q \quad (3)$$

z is a ratio signal based on [based on a constant in moisture regain, and p and q] the measurement signal of a moisture meter in x . Moisture regain z is called for by the operation only by measuring x by this (3) type.

[0015] The calibration-curve parameter data (p, q in this case) called for automatically as mentioned above are outputted to communication line 15 grade, and a direct input is carried out to the operation means 16 of water measurement equipment 2, and they are used for the moisture-regain measurement

operation of the output of a moisture meter 17. Moreover, human being may make a calibration-curve parameter input into the operation means 16 indirectly manually with the calibration-curve data outputted to the printer 14. That is, in the operation means 18, it asks for the ratio output x from the measurement signal about a moisture meter 17, and is converted into moisture regain z based on a calibration curve like the above-mentioned (3) formula, and moisture-regain measurement by infrared radiation is performed. In addition, it miniaturizes, and the operation means 16 is built into a moisture meter 17, and is [like a personal computer] good also as one.

[0016] By the way, **** resulting from the light source, a filter, a component, etc. is between the 1st moisture meter 7 of the above, and the 2nd moisture meter 17, and the above-mentioned measurement signals S , $R1$, and $R2$ are not in agreement, it is incompatible, and the calibration-curve data in the 1st moisture meter 7 may be unable to use it as it is. In this case, **** amendment is performed as follows and the property of each moisture meter is made in agreement.

[0017] That is, in the above-mentioned calibration-curve listing-device 1 grade, the measurement-signal outputs $R1$, S , and $R2$ when measuring the 1st criteria object 31 with the 1st standard moisture meter 7 are set to α , β , and γ , and the measurement-signal output when measuring the 2nd criteria object 32 is set to δ , ϵ , and ζ . And in the above-mentioned calibration-curve listing device 1, the measurement-signal outputs $R1$, S , and $R2$ when measuring the 1st same criteria object 31 with the 2nd moisture meter 17 amended are set to a , b , and c , and the measurement-signal output when measuring the 2nd same criteria object 32 is set to d , e , and f . In addition, the criteria object is used as a different criteria object from a criteria object or this with the almost fixed spectral characteristic. At this time, machine difference correction value is respectively calculated as follows with the processing means 6, for example.

[0018]

Correction value of $R1$ $A = (\alpha/a)$ and $(\delta/d) = (\alpha\delta)/(ad)$ (4)

S ***** $B = (\beta/b)$ and $(\epsilon/e) = (\beta\epsilon)/(be)$ (5)

Correction value of $R2$ $C = (\gamma/c)$ and $(\zeta/f) = (\gamma\zeta)/(cf)$ (6)

The measurement-signal outputs $R1$, S , and $R2$, then the ratio signal x of the moisture meter 17 amended are searched for from a degree type by two colors and 3 color methods using these.

[0019]

$S/R1 = (B-S)/(A-R1)$ (7)

$S/(R1+R2) = (B-S)/(A-R1+C-R2)$ (8)

Thus, by carrying out the amendment operation of each measurement-signal outputs $R1$, S , and $R2$ of the 2nd moisture meter 17 so that it may correspond to the reference values α , β , γ , δ , ϵ , and ζ of the 1st standard moisture meter 7, the measurement signal of the 2nd moisture meter 17 comes to correspond to the 1st moisture meter 7, and can give compatibility. That is, these correction value parameter data are inputted into the operation means 16, **** amendment is performed, and measurement of the right moisture regain z about a moisture meter 17 is performed by the calibration curve of (3) types for which it asked with the moisture meter 7 of the above-mentioned criterion.

[0020] In addition, the **** amendment using the criteria object 31 of the above 1st and the 2nd criteria object 32 may measure and amend only the 1st criteria object 31, and may measure and amend only the 2nd criteria object 32, and may measure and amend both criteria objects 31 and 32 as mentioned above.

[0021] Furthermore, it is shown by JP,61-61623,B using such $R1$, S , and $R2$ which were amended. (9)

$[2S/(R1+R2)] - f(R1/R2)$

** -- it may ask for a correction function [like] experimentally beforehand, and a moisture-regain operation may be performed using this. In addition, an amendment operation function like this (9) type and the amendment approach can consider various things, F and G are made into a different function, and, generally moisture regain Z serves as a degree type.

[0022]

$Z = F(S, R1, R2)$ and $G(R1, R2)$ (10)

It asks for this correction function with the processing means 6, and by including in other moisture meters, the individual calibration curve for every classification by the classification of a device under

test 3, for example, paper, is unnecessary, and serves as a moisture meter for moisture-regain measurement as a calibration-curve free-lancer who can be managed with one calibration curve.

[0023] Thus, the data of a standard moisture meter can be used for other moisture meters as it is by calculating automatical measurement of a calibration curve, and a calibration-curve free-lancer's function only with a standard moisture meter, acquiring data, carrying out **** amendment with a standard moisture meter and other moisture meters, and doubling a property.

[0024]

[Effect of the Invention] A desiccation means by which this invention dries a device under test as stated above, and a gravimetry means to measure the weight of a device under test, While calculating a calibration curve based on the measurement signal measured with the 1st moisture meter for measuring the rate of infrared absorption by the moisture contained in a device under test, and the weight signal and the 1st moisture meter which were measured with these gravimetries means It is the calibration-curve listing device, of the moisture meter equipped with a processing means to calculate correction value so that the measurement signal of the 2nd moisture meter may correspond to the measurement signal of the 1st moisture meter based on each measurement signal when measuring a criteria object with the 1st moisture meter and 2nd moisture meter. For this reason, a calibration curve can be created automatically, a troublesome manual activity like before becomes unnecessary, and large laborsaving can be attained. Moreover, since it amends so that the signal when measuring a criteria object may correspond to the reference value of a standard moisture meter, and he is trying to measure moisture regain Even if there is **** from which an output is different for every moisture meter with the difference in some property, it can be removed, and a highly precise right water measurement signal can always be acquired by the calibration curve of the optimal criterion, and the effect of **** can respond automatically also to change of the form of paper etc., and can aim at sharp man day reduction.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the configuration explanatory view showing one example of this invention.

[Description of Notations]

- 1 Calibration-Curve Listing Device
- 2 Water Measurement Equipment
- 3 Device under Test
- 4 Installation Base
- 5 Gravimetry Means
- 6 Processing Means
- 7 17 Moisture meter
- 8 Desiccation Means
- 9 Thermometer
- 10 Control Means
- 11 Actuation Means
- 12 Heat Insulation Container
- 13 16 Operation means
- 14 Printer
- 15 Communication Line

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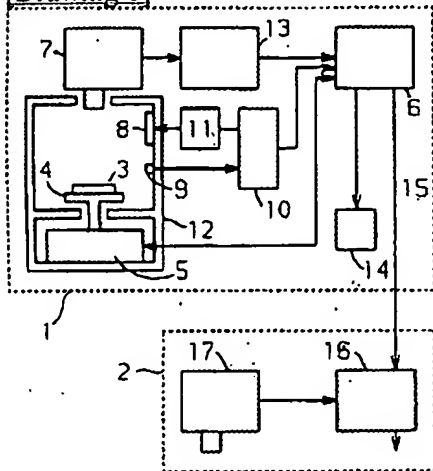
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DRAWINGS

Drawing 1]



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